SYNTAX ZX80®

A PUBLICATION OF **THE HARVARD GROUP**

VOL. 3 NO. 3 ISSN 0273-2696 MAR., 1982

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IAN LOGAN WINS FIRST ANNUAL ROSETTA STONE

Dr. Ian Logan of Skellingthorpe, UK, a frequent SYNTAX contributor, won the first annual Rosetta Stone award sponsored by Mindware Co. of Wayland, MA. Given for the best independent product--application, software package or peripheral--for ZX80/1s, future prizes will be awarded by SYNTAX editors. Dr. Logan won $100, a US computer magazine subscription, and a Rosetta Stone replica for his 8K ROM disassembly.

To nominate a product for next year's award, send the developer's name, address, and phone number with a description. To enter a product, also send the item plus documentation to SYNTAX Rosetta Stone Award, RD 2 Box 457, Harvard, MA, 01451.

TIMEX TO MARKET SR PRODUCTS IN NORTH AMERICA

Sinclair just announced a license with Timex to manufacture and retail Sinclair computers, peripherals and software via Timex outlets in N. America. Expect the change this fall. Sinclair will then stop selling by mail and you can buy Sinclair products at stores. We don't know which stores yet.

64K RAM AVAILABLE MID-MARCH

Memotech's new 64K plug-in RAM will be available in March for $199 US. Contact distributor Gladstone Electronics, 901 Fuhrmann Blvd, Buffalo, NY 14203, or 1736 Avenue Rd, Toronto, Ontario M5M 3Y7.

AUTHORIZED SINCLAIR REPAIR SERVICES

MicroSync Services will take over Sinclair's repair work for ZX80s and ZX81s (kits and assembled) and 16K RAMs. They also offer $10 yearly maintenance contracts. Send SASE to MicroSync Services, Customer Service Dept, 162R Marlboro St, Keene, NH, 03431.

SYNTAX ERROR: Lawrence Souder reported an error in his 4K Phone Number Word Generator program (Feb.82). Line 110 should read NEXT Z, not NEXT X.
Lori Olson's simultaneous equation program contained two typos:

```
 80 FOR H=1 TO I-1
110 NEXT J
```

PROGRAM IMPROVEMENTS

Tom Finley sent these improvements to R.F. Fraser-Smith's 8K Digital Clock (Nov.81):

```
200 IF H<10 THEN LET D=19
201 IF H>=10 THEN LET D=18
202 IF M<10 THEN LET E=22
203 IF M>=10 THEN LET E=21
206 PRINT AT 21,D;H;":00"
208 PRINT AT 21,E;M;"   ";M$
```

To run Hexadecimal Math (Dec.81) with an 8K ROM, make these changes from Leo Morgan of Peabody, MA:

```
 90 DIM (2)
180 LET N(1)=D
230 LET N(2)=D
240 IF C=2 THEN LET D=N(1)+N(2)
250 IF C=3 THEN LET D=N(1)-N(2)
260 IF C=4 THEN LET D=N(1)*N(2)
270 IF C=5 THEN LET D=N(1)/N(2)
370 FOR X=1 TO 4
500 DIM H(4)
580 PRINT CHR$ (H(4));CHR$ (H(3
));CHR$ (H(2));CHR$ (H(1));
```

Clifford Efaw of Morton, WA, sent these changes to run 4K Blackjack (Jan.82) with 8K ROM:

```
370 LET X=INT (X*52)+1
670 PRINT P(Z),CHR$ (15)
```

DEFENSIVE AWARI

I finally figured out the computer's defensive moves for my Awari program (Feb.82) to improve the play for better players. These additions foresee the consequences of a second move by the human, improving the original version in Basic Computer Games. The additions yield approximations only--they don't add a point to the opponent's score for passing home on the way to a zero pile or for a second move--but in general they'll make the right move. The change in line 330 avoids repeating a previous move. You can eliminate lines 270-290 since the Sinclair won't invariably move pile 1 following pile 4 and leave you to move pile 5 for 6 points. Unfortunately the initial move is always pile 4, which is a bit repetitious.

Change these lines:

```
330 LET H1=-99
371 LET Q=0
372 FOR T=1 TO 6
373 IF A(T)=0 THEN GOTO 381
374 LET R=0
375 LET U=A(T)+T
376 IF U>14 THEN LET U=U-14
377 IF U=7 THEN LET A(T)=0
378 IF U=7 THEN GOTO 372
379 IF A(U)=0 THEN LET R=A(14-U
)+1
380 IF R>Q THEN LET Q=R
381 NEXT T
382 LET H2=A(14)-A(7)-Q
390 IF M=14 AND K=2 THEN LET H2
=H2+2+Q
400 IF ABS(H1-H2)<1 THEN LET H2
=H2+RND-.5
```

Jon Passler, Beverly, MA

EDUCATIONAL SOFTWARE VENDOR

Edson Electronics now offers educational programs for ZX80/81s with elementary school level arithmetic, spelling, and counting exercises (9 learning plus 3 game programs). Programs require 8K ROM/2K RAM. Listings plus documentation are $14.95, tapes are $12.95 (both for $24.95). Edson also has a digital VU meter for $28.95 to monitor cassette loading and help eliminate loading problems. Edson Electronics, PO Box 151211, Tampa, FL 33684, 813/870-0282.

Remember to return your white renewal card within two weeks of our postmark to get a free SYNTAX magazine binder.

TRANSLATING PROGRAMS: ON...GO TO

Revising some programs for use on your ZX80/81 requires total knowledge of that computer language and its usage. One such term that you will stumble over is the ON...GO TO or ON...GO SUB statement. A program line might read:

```
90 ON X GO TO 100,10,333,2000,59
```

The computer compares the value of X with the line. If X=1 then it will GO TO line 100, if X=2 then line 10, if X=3 then line 333, etc. The same thing will happen if the line reads:

```
90 ON X GO SUB 100,10,333,2000,59
```

Notice that if X does not equal any number 1-5, the computer moves to line 91. In other words, if X equals a negative number, zero, or a number greater than 5, the computer skips that line.

One revision method is to list the numbers:

```
90 IF X=1 THEN GOTO 100
91 IF X=2 THEN GOTO 10
92 IF X=3 THEN GOTO 333
```

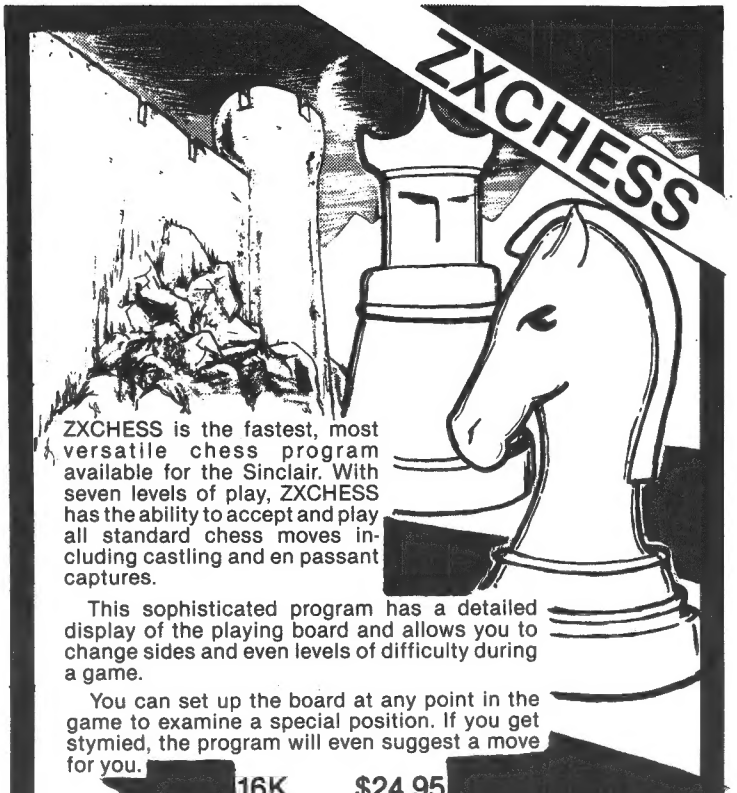
If you use GO SUB instead of GOTO, check for RETURN statements. For instance, if line 92 reads IF X=3 THEN GO SUB 333, then a line following line 333 must have a RETURN statement.

A second revision method is the COMPUTED way, like 90 GO TO X*100. If X=3, the computer goes to line 300. Using this method, the computer will go to any value of X (it will even search for a negative line number).

A third revision method is the DIM-ARRAY way, using a dimensioned array containing the line numbers. See SYNTAX (Dec.81 p.18) for this type of data storage.

The computed method uses the fewest bytes and runs at the slowest speed, since it must compute each GO TO. The listed way is somewhat faster. The array method is quick if the DIM statement is near the beginning of the program.

Mort Butler, BW Sabre, Houston, TX



ZXCHESS is the fastest, most versatile chess program available for the Sinclair. With seven levels of play, ZXCHESS has the ability to accept and play all standard chess moves including castling and en passant captures.

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TECHNICAL DETAILS FOR ZX PRINTING

Although Sinclair's printer is not available in the US yet, we got a British model and dissected it. We suggest that when and if you get one, you NOT dissect it--it's surprisingly tough to reassemble. Here's how the ZX printer talks to the 8K ZX80/81. (The 4K ROM does NOT support printing.) With this info you can start interfacing dot print mechanisms to ZX81s.

Your computer contains a 33-byte buffer in RAM, named PR-BUFF, starting at address 16444. In the ROM, routines for LPRINT, LLIST and COPY take character codes from this buffer, transform them to dot patterns using patterns stored in ROM beginning at 1E00H, and send them to the bus for the printer to use. The ZX printer accepts this SERIAL data and prints DOTS to form characters.

Data to the printer consists of instructions to draw a picture of the characters, one 32-character (or 256-dot) line at a time. Eight consecutive lines of dots form one row of characters.

Although the computer and the printer exchange several pieces of data, the principal data are the request from the printer to send the next dot and the instruction from the computer to print the next dot. Auxiliary signals tell the printer how to control the motor and inform the computer that the printer is connected and the stylus is on the paper. All signals pass in and out through the Z80 accumulator, or A register.

ZX printers function like a TV picture, scanning from left to right. A belt pulls a conductive stylus quickly across the paper, and where a black dot is wanted a pulse of current is passed through the stylus. This evaporates the aluminum coating on the paper, exposing the black backing. To avoid the need to return the stylus rapidly to the left hand edge of the paper, two styli, equally spaced on a moving belt, follow each other. Thus one leaves the paper as the other arrives in quick succession. The belt and the paper feed roller are both driven continuously while printing, so when the next stylus comes round the paper has moved up to the next line.

So that the styli always stop off the paper, the BASIC commands slow the motor for the last two scans before stopping--this makes the graphics join up if done in several goes; put this feature in any machine language program that requires the printer to stop while the computer works out the next line. At full speed, each pen is on the paper for about 32mS and off it for about 16mS. Since the motor speed can vary, an encoder disc is used to give 256 pulses across a 92mm printing width (allowing 4mm margins). These pulses are synchronized with the stylus hitting the paper to keep the printing vertical.

There are about 60uS between the starts of successive pulses at full speed.

The printer is wired as a Z80 I/O port, selected by A2 being at a low level--no other address lines are recognized. Sinclair always calls this port as 00FBH (251dec) in software, but does not fully decode the address in hardware. So to send information to the printer use the Z80 command: OUT(FB),A--OPCODE D3 FB, assuming the data is in register A. The data bits have the following meanings:

D2 high means stop the motor,
   low means start it.
D1 high means put the motor at slow
   speed--D2 high overrides this
D7 high applies power to stylus.

On the printer side of the interface all these lines remain in the state they were last, until new data is sent to the printer. At switch on, or after pressing the

feed button, D1 and D7 are set low; D2 stays high after feed. The other data lines aren't used.

To fetch information from the printer, the Z80 instruction: IN A, (FB)--OPCODE DB FB--will put data into the accumulator. These bits are used:

D6 will be read as low if the printer is there, high if it isn't, and is used solely to check if printer is connected.
D0 is the signal from the encoder disc.
D7 is high when the stylus hits the paper.

D0 and D7 are both latched on the printer side of the interface so they remain high until the computer writes something to the printer. So even if you don't make use of the information you read in, use an output instruction with appropriate data to reset the latches until the next signal. These bits may be in either state on switch on, and are unaffected by the feed button. The paper detect signal is also used internally by the printer to make sure the styli stop off the paper. If power is applied to the stylus, the paper signal will go high even if the printer is between scans; turn the stylus off before trying to detect the paper edge.

All printing is done in FAST mode. The COPY command prints a full screen in 12 seconds.

All ROM code to control printing appears to lie between 0802H and 0918H, based on a quick look at Ian Logan's ROM disassembly. A call to 0871H (USR 2161) prints the characters stored in the printer buffer, then clears the buffer.

SYNTAX (02/08/13) describes a port interface, including a schematic for another address, that you can easily modify. Simply use address lines A0-A7, IORQ, and RD or WR to select address, port, and direction. Use D0-D7 to carry data to and from the accumulator. Use 74LS75s to latch the data in and out, and use LS-series gates elsewhere when they connect to the ZX80/81 bus.

You can use Ian Logan's annotated ROM disassembly to examine the Sinclair software that executes the LPRINT, LLIST, and COPY functions. You can move the COPY-BUFF and output routines to RAM using a program suggested in Sinclair's printer manual. First POKE 16389, 124 and NEW to set aside memory for the machine language routine. Next, use the following code to move the ROM routine to RAM.

```
 5 FOR I=0 TO 112
 6 POKE 31744+I,PEEK (2161+I)
 7 NEXT I
 9 POKE 31857,201
```

Call this routine using USR 31744.

This routine will now read character codes, which you must POKE into PR-BUFF, and translate them into dot codes using the patterns in ROM. The buffer is NOT cleared by this routine.

If you want to store different patterns, POKE them into the 256 bytes starting at 32256 (the space is already set aside) and POKE 31800,63 (to restore the ROM as dot source POKE 31800,15).

Each successive byte stores the 8 dots for a row of printout of one character. The ninth byte thus contains the first row of the second character in the set. By defining bit patterns here you can define a new character set. Specify all 8 bytes for each character.

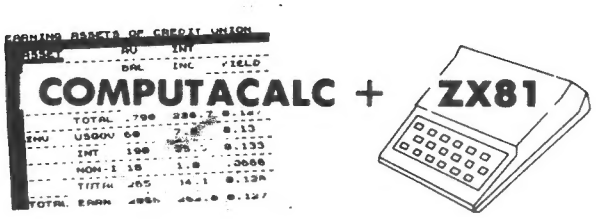
SOFTWARE HINT

My son finished off a recent program for me thusly:

```
9950 SAVE "Name of Program"
9960 GOTO (First line of Program)
```

To SAVE this on tape, I just type GOTO 9950 instead of the more time-consuming SAVE "Name of Program".

Herb Sturges, Orinda, CA



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NUMBERS HELD INEXACTLY ON THE ZX81

This is the first of several articles by Dr. Frank O'Hara on numerical errors in the ZX81's 8K ROM floating point.--AZ

All floating-point systems require certain techniques of rounding, general approximation and slightly over- or under-stating numbers to make the arithmetic work. The problem is particularly acute in the ZX81 because 1) all numbers, even integers, are held in floating-point form; 2) of the almost total lack of instruction in floating-point techniques in the manual or the literature; and 3) the limitation of the ROM to 8K and the premium on every byte.

In doing arithmetic on the ZX81, it helps to know just which numbers are held exactly in its BASIC and which are not. This small program shows you exactly how any number is held on the ZX81:

```
Program 1
  10 INPUT X
  20 LET V=PEEK 16400 +256*PEEK
16401
  30 FOR I=V+1 TO V+5
  40 PRINT PEEK I;" ";
  50 NEXT I
  60 PRINT
  70 GOTO 10
```

INTEGER POWERS OF 2: To use this program, RUN it and first enter 0 to satisfy yourself that 0 is held as five zeros as the manual says. Then try some small integer powers of 2, like 1 (or 2^0), 2, 4, 8. You'll get 129 0 0 0 0; 130 0 0 0 0; 131 0 0 0 0; and 132 0 0 0 0. Before explaining this, let me give you a program to generate all integer powers of 2 from 1 to 126. First delete line 10 from Program 1 and replace line 70 with 70 RETURN. Then add these lines to give:

```
Program 2
(lines 30-70 from Program 1)
 100 LET X=1
 120 FOR J=1 TO 126
 130 PRINT J;"  ";
 140 LET X=2*X
 150 GOSUB 30
 160 NEXT J
```

Finally, make line 20 be line 110 and delete the old line 20. To run, press GOTO 100 then NEWLINE (NL) or ENTER. The first 22 powers of 2 will appear, each in the form (129 plus n) 0 0 0 0 for the nth power. To see the other 5 screenfuls, continue in FAST at about 7 seconds per screenful. You should then be convinced the manual has got it right on this point. After seeing the 126th power (255 0 0 0 0), try PRINT 2*X. You'll get report 6/0 for arithmetic overflow. The ZX81 cannot hold 2 to the 127.

To see the negative powers of 2, replace line 140 by LET X=X/2 and change 126 to 140 in line 120. RUN 100 and you get the powers from 2^{-1} (128 0 0 0 0) to 2^{-128} (1 0 0 0 0). From -129 to -140 the powers should all be held as zero (0 0 0 0 0), but here we meet our first quirk of the ROM. On division by

2, 2^{-128} becomes 2^{-129} and is promptly rounded up to 2^{-128} again! So our innocuous little program has got us stuck here. Try LET X=X/4, then GOTO 30 (NOT RUN 30) and you will get 0 0 0 0 0 and of course report 7/70 (RETURN with no GOSUB). If you have the patience to run the program again with 128 in line 120, you can use this same method to get a zero result for 2^{-130}. If you want a zero result for 2^{-129} you have to fall back on the the otherwise less accurate type of expression LET X=2**-129.

So we have a simple way of generating the exact representation of integral powers of 2 on the ZX81 (except for 2^{-129}). We see that, as we expect from the manual, 2^n is given by (129 plus n) 0 0 0 0 where n equals -128 to 126 inclusive.

Now compare these exact results with the expression 2**N. To do this, produce Program 3 from Program 2: Make sure that line 120 contains 126 and change line 140 to LET X=2**J. RUN 100 and note the 19 inaccuracies at the powers 13, 26, 27, 31, 52-54, 61, 62, 104-108 and 121-125. Running the negative powers reveals similar inaccuracies at corresponding negative powers.

Note in particular that PRINT 2**13-8192 gives .000022888184. That extra 6 in the last byte is $3/2^{17}$, about .00002. The inaccuracy arises because the ROM evaluates 2**13 by approximate methods as EXP (13*LN2). Of course, 8192.00002 may be accurate enough for most purposes, but it may help you to know that it is not completely accurate and you can always get it exactly if you need it by 2*2**12. The same holds for any other inaccurately held powers. For example, the important number 2^{31} is given exactly by 2*2**30 or by 2**32/2. So Euler's famous prime can be got quickly by 2**32/2-1.
Next month: Positive integral powers of 10.

Frank O'Hara, Surbiton, Surrey, UK

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HARDWARE HINTS

Overheating: EZUG (Educational Users' Group) newsletter reports a reader's solution to overheating. He filed off the raised ZX81 name, then put a solid block of steel about the size of a pack of cigarettes on top of the case. A similar copper block copper keeps the transformer cool. Reprinted by permission, EZUG Newsletter, Jan/Feb 82, p.16, Highgate School, Balsall Heath Road, Birmingham B12 9DS England.

Memory Loss: One of SYNTAX's machines displayed memory loss, partial characters and other strange symptoms. We tracked it to defective solder joints on the component side of the board at the regulator IC. Under a magnifier, defective joints look like conical pits around one or more of the 7805 pins. Touching up the solder cured all the symptoms.

INCOME TAX--8K/16K

It's that time of year again and I hope that TAX will reduce some of the nuisance of tax return preparation, if not the pain in the pocket. It is designed to aid in year-end form preparation and also to allow periodic monitoring of tax liability during the year. You may be able to reduce the amount withheld from your salary or the amount of your quarterly payments if self-employed. Personally, I'd rather have the money during the year than have the IRS hold it for me.

Lines 100-152 provide the main menu of functions with line 170 serving as an error trap for accidental entries. You can quickly see the program's various capabilities. Tax calculation includes all arithmetic and transferring totals to appropriate lines.

The PAUSE subroutine at lines 6000-6030 allow you to view various displays as long as desired before proceeding. The form selection subroutine is at lines 7000-7214. Although this listing includes only Form 1040 and Schedule A, you can add any additional forms using the same principles illustrated. The particular variables allow this flexibility. Z is the offset in line numbers for each form with allows all line numbers and descriptions to be stored in a single sequential array but allows you to enter the line numbers on the IRS form. P is the number of "pages" used to display the given form. Each value of J is the starting line for each display page; each value of K is the ending line. This allows overlap of displays as appropriate.

Lines 1000-1120 provide the data entry function and begin with form selection through GOSUB 7000. You are then prompted for line number and amount. The amount is added to the previous total for this line and the new total displayed. This allows periodic updating during the year and revisions during year-end form preparation. Make negative corrections by entering negative numbers.

Lines 2000-2248 perform all arithmetic for lines that require it. Schedule A (lines 2200-2248) must be done first so that Form 1040 (lines 2100-2182) will have that information. Lines 2120-2122 require you to refer to the tax tables for the tax on the amount in Form 1040 line 34. Lines 2124-2126 request any additional taxes. The "bottom line" is displayed by lines 2174-2178. In the calculation of Schedule A, the total deduction is displayed by 2242.

Lines 3000-3080 allow you to view all line items on the form selected. GOSUB 7000 illustrates its usefulness here by allowing a short subroutine to serve for all present and future forms. Line numbers, descriptions and amounts are presented. Changing the line number I to I$ makes for a more attractive display.

Lines 4000-4060 record the program and all variables, including line descriptions and amounts. This also makes the program self-starting upon LOADing and eliminates the danger of erasing everything with a RUN instead of a GOTO.

Lines 5000-5030 erase all line amounts to let you keep the line descriptions intact when starting a new tax year.

Lines 9000-9050 are for initializing the program. The REM statements indicate direct commands that should be entered when the program is being initialized. Line descriptions are typed in by first commanding GOTO 9020. The prompt provides a guide to the maximum length of the description (18 spaces) by printing 16 *s after the line number. The direct command LET J=1 allows later addition of forms and line descriptions. Setting J to the new line number saves previous entries. The number 107 is the total lines in Form 1040

and Schedule A. If you add more forms to the program, you must increase 107 wherever it occurs.

After initializing TAX, enter GOTO 100 to get to the main menu and either begin using it or record it for later use.

Lane Lester, Lynchburg, VA

Enter all data that cannot be computed on Form 1040 or Schedule A. Run CALCULATE TAX routine on Schedule A first; totals are automatically transferred to Form 1040. For lines on Form 1040 with sub-lines a, b, c and d, enter each sub-item to the main line number. The screen shows the latest entry and the total. You can only go forward through the form; enter zeros until the main menu comes up to go back.--KO

(Mar.82 listings are printed on a Sinclair ZX printer. Comments?)

```
 100 PRINT AT 3,6;"INCOME TAX RE
TURN"
 110 PRINT AT 6,4;"PRESS DESIRED
 FUNCTION"
 120 PRINT AT 8,6;"1. ENTER DATA
"
 130 PRINT AT 9,6;"2. CALCULATE
TAX"
 140 PRINT AT 10,6;"3. REVIEW DA
TA"
 150 PRINT AT 11,6;"4. RECORD DA
TA"
 152 PRINT AT 12,6;"5. ERASE ALL
 ENTRIES"
 155 PAUSE 40000
 160 LET K$=INKEY$
 170 IF K$<"1" OR K$>"5" THEN GO
TO 190
 180 GOSUB VAL K$*1000
 200 GOTO 100
 999 REM [illegible]
1000 GOSUB 7000
1010 PRINT AT 6,8;"LINE NUMBER"
1020 INPUT Y
1030 PRINT AT 6,20;Y
1040 LET X=Y+Z
1050 PRINT AT 8,8;"AMOUNT $"
1060 INPUT A
1070 PRINT AT 8,16;A
1080 LET L(X)=L(X)+A
1090 PRINT AT 10,8;"TOTAL  $";L(
X)
1100 GOSUB 6000
1120 GOTO 100
1999 REM [illegible]
2000 GOSUB 7000
2020 GOSUB VAL K$*100+2000
2030 RETURN
2099 REM [illegible]
2100 LET L(21)=0
2102 FOR I=7 TO 20
2104 LET L(21)=L(21)+L(I)
2106 NEXT I
2108 LET L(30)=0
2110 FOR I=22 TO 29
2112 LET L(30)=L(30)+L(I)
2114 NEXT I
2116 LET L(31)=L(21)-L(30)
2117 LET L(32)=L(107)
2118 LET L(34)=L(31)-L(32)-L(33)
2120 PRINT AT 21,0;"ENTER TAX FO
R $";L(34)
2122 INPUT L(35)
2124 PRINT AT 21,0;"ENTER ADDITI
ONAL TAXES "
2126 INPUT L(36)
2128 LET L(37)=L(35)+L(36)
2130 LET L(46)=0
2132 FOR I=38 TO 45
2134 LET L(46)=L(46)+L(I)
2136 NEXT I
2138 LET L(47)=L(37)-L(46)
2140 LET L(54)=0
2142 FOR I=47 TO 53
2144 LET L(54)=L(54)+L(I)
2146 NEXT I
2148 LET L(62)=0
2150 FOR I=55 TO 61
2152 LET L(62)=L(62)+L(I)
2154 NEXT I
2156 LET X=L(62)-L(54)
2158 IF X<0 THEN GOTO 2166
2160 LET L(63)=X
2162 LET L(64)=L(63)-L(65)
2164 GOTO 2174
2166 LET L(63)=0
2168 LET L(64)=0
2170 LET L(65)=0
2172 LET L(66)=X*-1
2174 FOR I=63 TO 66
2176 PRINT AT I-53,0;I;" ";C$(I)
;" $";L(I)
2178 NEXT I
2180 GOSUB 6000
2182 RETURN
2199 REM [illegible]
2200 LET L(70)=L(68)-L(69)
2202 IF L(69)>L(68) THEN LET L(7
0)=0
2204 LET L(73)=L(70)+L(71)+L(72)
2206 LET L(74)=.03*L(31)
2208 LET L(75)=L(73)-L(74)
2210 IF L(74)>L(73) THEN LET L(7
5)=0
2212 LET L(75)=L(67)+L(75)
2214 LET L(82)=L(77)+L(78)+L(79)
+L(80)+L(81)
2216 LET L(85)=L(83)+L(84)+L(85)
2218 LET L(90)=L(87)+L(88)+L(89)
2220 LET L(95)=L(91)+L(92)+L(93)
+L(94)
2222 LET L(98)=L(96)+L(97)
2224 LET L(99)=L(76)
2226 LET L(100)=L(82)
2228 LET L(101)=L(86)
2230 LET L(102)=L(90)
2232 LET L(103)=L(95)
2234 LET L(104)=L(98)
2236 LET L(105)=L(99)+L(100)+L(1
01)+L(102)+L(103)+L(104)
2238 LET L(107)=L(105)-L(106)
2240 IF L(106)>L(105) THEN LET L
(107)=0
2242 PRINT AT 15,0;"41 ";C$(107)
;" $";L(107)
2244 GOSUB 6000
2248 RETURN
2999 REM [illegible]
3000 GOSUB 7000
3010 FOR N=1 TO P
3020 FOR I=J(N) TO K(N)
3025 LET I$=STR$ I
```

```
3030 PRINT I$;" ";C$(I+Z);" $";L
(I+Z)
3040 NEXT I
3050 GOSUB 6000
3070 NEXT N
3080 RETURN
3999 REM RECORD DATA
4000 CLS
4010 PRINT AT 8,7;"PREPARE RECOR
DER"
4020 PRINT AT 10,3;"PRESS ANY KE
Y WHEN READY"
4030 PAUSE 40000
4040 CLS
4050 SAVE "TA"
4060 GOTO 100
4999 REM ERASE ALL ENTRIES
5000 CLS
5005 FOR I=1 TO 107
5010 LET L(I)=0
5020 NEXT I
5030 PRINT AT 10,7;"ALL ENTRIES
ERASED"
5999 REM PAUSE
6000 PRINT AT 21,3;"PRESS ANY KE
Y TO CONTINUE"
6010 PAUSE 40000
6020 CLS
6030 RETURN
6999 REM FORM SELECTION
7000 CLS
7010 PRINT AT 6,7;"PRESS DESIRED
 FORM"
7020 PRINT AT 8,9;"1. FORM 1040"
7030 PRINT AT 9,9;"2. SCHEDULE A
"
7082 PAUSE 40000
7084 LET K$=INKEY$
7086 IF K$<"1" OR K$>"2" THEN GO
TO 7000
7088 CLS
7090 GOSUB VAL K$*100+7000
7092 RETURN
7099 REM FORM 1040
7100 PRINT AT 0,11;"FORM 1040   "
7102 LET Z=0
7104 LET P=4
7106 LET J(1)=7
7108 LET J(2)=21
7110 LET J(3)=37
7112 LET J(4)=47
7114 LET K(1)=21
7116 LET K(2)=37
7118 LET K(3)=54
7120 LET K(4)=66
7130 RETURN
7200 PRINT AT 0,11;"SCHEDULE A"
7202 LET Z=66
7204 LET P=2
7206 LET J(1)=1
7208 LET J(2)=21
7210 LET K(1)=20
7212 LET K(2)=41
7214 RETURN
8999 REM INITIALIZATION
9000 REM LET J=1
9002 REM DIM J(4)
9004 REM DIM K(4)
9006 REM DIM C$(107)
9008 REM DIM L(107)
9010 REM DIM I$(3)
9012 REM FAST
9020 FOR I=J TO 107
9025 LET I$=STR$ I
9030 PRINT AT 21,0;I$;"*********
********"
9040 INPUT C$(I)
9050 NEXT I
SYNTACTIC SUM:   52866, 8K
```

VIDEO ARTIST--8K/2K

This program shows the ZX81's ability to draw pictures under BASIC control. Run the program and enter the title of your work. Hit NEWLINE or ENTER, and you get a flashing cursor in the center of the screen. This is the editing cursor. Control the direction of this cursor in real-time with keys 5-8. The cursor moves in the direction of the arrows on the keys. In this mode you can move anywhere on the screen.

To start drawing, press 1. This puts the computer in plot mode. Again, you have real-time directional control by pressing keys 5-8. To erase, go back to edit mode (hit 0) and move the cursor over the line to erase.

When you finish a masterpiece, you can save it on tape. Turn on your recorder and press S. It saves under the title you gave it.

You can exit just about any time by pressing BREAK. This program should run in 2K RAM for those of you who have modified your ZX81's or added a 16K RAM pack.

Lance Ward, Lansing, MI

```
  5 LET X=32
 10 LET Y=20
 15 PRINT "ENTER TITLE."
 20 INPUT A$
 25 CLS
 30 PLOT X,Y
 40 UNPLOT X,Y
 50 IF INKEY$="5" THEN LET X=X-
1
 60 IF INKEY$="6" THEN LET Y=Y-
1
 70 IF INKEY$="7" THEN LET Y=Y+
1
 80 IF INKEY$="8" THEN LET X=X+
1
 90 IF INKEY$="1" THEN GOTO 100
 95 GOTO 30
100 PLOT X,Y
110 IF INKEY$="5" THEN LET X=X-
1
120 IF INKEY$="6" THEN LET Y=Y-
1
130 IF INKEY$="7" THEN LET Y=Y+
1
140 IF INKEY$="8" THEN LET X=X+
1
150 IF INKEY$="0" THEN GOTO 30
160 IF INKEY$="S" THEN SAVE A$
170 GOTO 100
SYNTACTIC SUM:   23487, 8K
```

ANOTHER $100 MISUNDERSTANDING

I just finished rebuilding my ZX81 kit. If Sinclair had sent complete instructions with my kit (delivered in early Jan.82) I would not have needed to reopen the case, desolder and remove two components, and add seven new ones. I can't believe that Sinclair singled me out to receive a kit with incomplete instructions, so what follows may help others whose ZX81s won't work and wonder why they have two resistors, two capacitors, two little red coils and an oddly shaped metal strip left over after finishing the assembly per instructions.

Instructions with my kit called for only 12 capacitors (C1-C12) to be installed on the board. They didn't mention two red-wire induction coils. They offered no special instructions for installing R27 and R29. And they didn't even mention a grounding strip, let alone describe how to install one. If the instructions you got are similarly lacking, take note.

Sinclair advises (after I wrote) that you install R27 and R29 vertically. You should find two pairs of resistors of the correct values (R27=1K, R29=1M). Use the pair that are preformed for vertical installation.

You will also find two surplus 47nF capacitors (marked 473 Z) when you finish the assembly per the instructions. These are C13 and C14. It's easy to spot the board location for C13, but the callout for C14 is hidden under the 9V jack. The C14 location is between the end of the jack and the edge of the board.

It is easy to spot the locations for inductors I1 and I2, just above the regulator. Plug the red-wire coils into these locations (I1 and I2 bring the 9V supply to the regulator, without them the board is stone-cold dead). Solder all these components to the board.

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Finally, install the left-over weird-looking metal strip so that its long bent-up end passes between the heat sink and the edge of the board, with that end in position to contact the top of the case once the board is screwed down. Solder the other end of the strip to the arrow-shaped area just below the slot in the board. Then solder the other portion of the strip with a single small hole in it to the rectangular area provided adjacent to the regulator.

My 8K/1K ZX81 ran satisfactorily with horizontal rather than vertical resistors, without the two additional capacitors, and without the grounding strip. It runs even better now with the changes and added components. The TV display is clearer and more steady and seemingly, keyboard entry is faster and easier.

Bob Nadler, Englewood, NJ

The $149.95 personal computer.

Introducing the Sinclair ZX81

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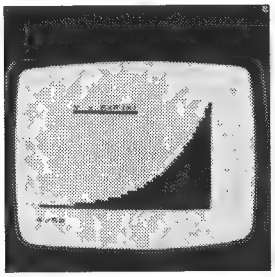
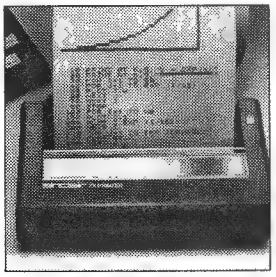
**Does not apply to ZX81 kits.

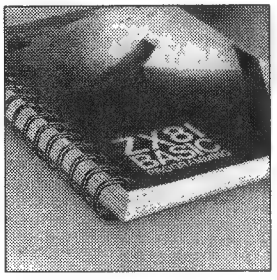


NEW SOFTWARE: Sinclair has published pre-recorded programs on cassettes for your ZX81, or ZX80 with 8K BASIC. We're constantly coming out with new programs, so we'll send you our latest software catalog with your computer.



ZX PRINTER: The Sinclair ZX Printer will work with your ZX81, or ZX80 with 8K BASIC. It will be available in the near future and will cost less than $100.

16K MEMORY MODULE: Like any powerful, full fledged computer, the ZX81 is expandable. Sinclair's 16K memory module plugs right onto the back of your ZX81 (or ZX80, with or without 8K BASIC). Cost is $99.95, plus shipping and handling.



ZX81 MANUAL: The ZX81 comes with a comprehensive 164-page programming guide and operating manual designed for both beginners and experienced computer users. A $10.95 value, it's yours free with the ZX81.

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If you really want to save money, and you enjoy building electronic kits, you can order the ZX81 in kit form for the incredible price of just $99.95.* It's the same, full-featured computer, only you put it together yourself. We'll send complete, easy-to-follow instructions on how you can assemble your ZX81 in just a few hours. All you have to supply is the soldering iron.

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DEAR EDITOR:

Here's a better way to stop the listing and editing of an 8K program. Make the first line of your program 1 REM X. After typing in your program, enter with no line number POKE 16514,118 and POKE 16509,40. This will stop the listing. When you try EDIT or LIST, it gives you A241 REM no matter where the program cursor is.

To get out of this mode, POKE 16509,0 and POKE 16514,61.

Andrew Lederman, Pittsford, NY

In the Feb.82 issue, George Luhrs asked for a linear regression program. We have one for 8K ROM/ 1K RAM or more for $2.50. It puts the best line through x,y data points. Ask about our business Linear Programming system.

If you're strung for bytes, use LET A=0 and LET A=A+1 instead of DIM A(1) and LET A(1)=A(1)+1 for the sum-to-memory and counter method I described in Feb.82.

Paul Ezra, Ezra Group II, Box 5222, San Diego, CA, 92105, 714/584-8291

In spite of Gary Vincent's authoritarian tone in his Feb.82 letter about painting heat sinks, I believe he is incorrect.

Copies of applicable sections of the Motorola and National Voltage Regulator Handbooks are enclosed to document the positive effects of painting aluminum heat sinks black. The effect of increased emissivity varies with the heat sink's parameters but black paint always helps!

Chuck Hutton, Atlanta, GA

Chuck included tables from the Handbooks showing emissivity values for various surfaces. Painted or varnished surfaces have higher emissivities than polished or oxidized surfaces.--AZ

I'd like to hear from anyone interested in putting FORTH on the ZX80/81 or in defining a "standard" mapping between the ASCII and ZX81 character sets.

Rich Holmes, 1303 E. Wilson #204, Batavia, IL, 60510

I bought an 8K ROM and 16K RAM module for my ZX80. Here are some problems I found and my solutions:

1. The ZX81 keyboard overlay won't lay flat and bows up in the center when attached. Apply double sticky tape and press it onto the existing keyboard. It lays flat and keyboard sensitivity is unchanged.
2. The 16K RAM fits loosely, as it's only attached by the edge connector. If it comes loose with power on, the RAM may be damaged. Fit a 2"x5" piece of thin PC board material between the RAM foot pads, through the edge connector slot in the ZX80 case (I whittled mine out a little with a pen knife) and under the ZX80 PC board. Attach it to the RAM and to the bottom half of the ZX80 case with short, self-tapping screws. Reconnect the internal gournd spring (supplies ground from the PC board to the lower case coating) elsewhere.
3. The 16K RAM internal ribbon connector leads were not clipped during assembly at the factory. So the leads intermittently contact the conductive coating inside the case. As the coating has ground applied, the consequences are disastrous. Clip the leads.

Larry Lockwood, Yorba Linda, CA

Is anyone selling the MicroAce Flicker-Free kit for upgraded ZX80s and MicroAces stateside?

I got two surplus keyboards from John J. Meshna Inc. A fantastic buy for $20 each. On my 4K/16K system I mounted the computer (out of its case), 16K RAM and power supply in the keyboard. I removed

the cassette ports and remounted them at the back of the keyboard housing. I used the keyboard's 4 red keycaps for cursor functions, 10 black keycaps for numerics, and the remaining keys for standard alpha functions and separate tokens (such as TO, THEN, AND). I used the circuitry mentioned in SYNTAX (Vol.1 No.2) for the use of the extra keys without holding the SHIFT down. This keyboard was fairly easy to wire following the instructions in SYNTAX and Sinclair's schematic.

On my second system I wired the new keyboard to an externally accessable plug. I tapped off necessary connections on the ZX80 (8K/16K) and mounted its plug at the top of the case where my modulator used to be (I removed the modulator after I ran direct video out). This way I have portability or big keyboard features depending on where I'm computing.

Key caps on both keyboards were made from photocopied originals. Elmers glue holds them down. Spread a little extra on the tops to protect them from wear (it dries clear).

The keyboard also has a myriad of other helpful hardware such as a speaker with volume control, four switches (I used one for power and one for video select) and a number of small lights. All in all, a very worthwhile investment.

Russ Gagnon, Oscoda, MI

I don't know of anyone in the US selling the MicroAce board now. For info about Meshna's keyboard (#SPL-19), contact Doug Meshna, PO Box 62, E. Lynn, MA, 01904, 617/595-2275.--AZ

Jan.82 p.9 "More Hardware Hints" contains a number of useful hints, but you might find Cramolin better for cleaning and preserving metal-metal contacts. Old Colony Sound Labs, Audio Amateur, Box 243, Peterborough, NH 03458, sells both Cramolin cleaner and preservative for $9.95 (there are other sources). I would clean and protect the board edge contact of any ZX80/1 sent to me with return postage and $2.00.

Ron Miller, 3488 Douglas Drive, Murraysville, PA, 15668

USERS' GROUPS

We have received notice of these users's groups since last month. To check for a group in your area, call or drop us a note with a SASE. If you belong to or want to start a ZX80/81 users' group, let us know and we'll pass it on.--AZ

Los Angeles, CA: George Kuby, 213/550-5035 after noon or P.O. Box 34545, Los Angeles, CA, 90034.

San Francisco/San Jose, CA: Paul Perrault, Stanford Telecommunications Inc., 1195 Bordeaux Dr., Sunnyvale, CA 94086, 408/734-5300 x267.

Seattle/Tacoma/Everett, WA: Dan Gallery, 1619 E. John St., #414, Seattle, WA 98112, 206/325-8186.

Denver, CO: Cap Hamilton, 767 S. Gaylord St., Denver, CO 80209, 733-6857.

Fort Wayne, IN: Sinclair Midwest Users' Group, Robert Carroll, P.O. Box 13042, Fort Wayne, IN 46866.

Lynchburg, VA: Lynchburg Microcomputers Users Group, Lane Lester, 804/237-5961 Div. of Natural Science.

Central Pennsylvania: Bill Russell, RD 1 Box 539, Centre Hall, PA 16828, 814/364-1325.

New York, NY: ZX Users' Group of New York, Box 560 Wall St., New York, NY 10005.

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70 Boston Post Road
Wayland, MA 01778

HARDWARE REVIEW

Product: 4K/8K ROM Switch
From: Marex Electronics, 2805 Abbeyville Rd., Valley City, OH 44280
Price: basic kit, $24.95, assembled, $30.95; full-feature kit, $34.95, assembled, $49.95

The Marex ROM switch lets you use both your 4K and 8K ROMs on a ZX80 (a 4K ROM won't work on a ZX81). The basic kit comes with a 3" square PC board with plated-through holes, sockets and components, plus spacers and screws to put the case back together with the PC board inside. An extra $10 gets you the full-feature kit, which also gives cassette-load automatic gain control, a keyboard beeper and a reset-upon-ROM-switch so you don't have to pull the plug every time you switch ROMs. For kit assembly, you need wire cutters, a soldering iron, small screwdriver and pliers, drill and pen knife.

I put together the basic kit. It came with step-by-step directions, parts list, schematic and board layout drawing showing where everything goes. All the parts arrived, including about a foot of solder. Although not a hardware person, I had no trouble soldering the components to the board and plugging it into the computer.

But I did have trouble getting it to work. First, the directions, though very clear and simple, don't tell you how to avoid zapping your ROMs with static electricity. Not a big problem here at SYNTAX, where ROMs abound, but if you have only 2, it could be tough. Then we found a short between 2 ROM pins on the PC board. Rex Rickly of Marex tells us he caught this fault in one other board, and no one else has gotten one. It seems that some plated holes are too large, so the traces sometimes run too close, causing shorts.

Rex sent an assembled, tested board, and it works quite nicely. One of our ZX80s, which always resets slowly (several seconds with 1K RAM), would not work with the ROM switch board. But this machine only works marginally as it is.

If your luck runs better than mine and you get a good board, keep these things in mind: ground yourself when handling ROMs. When removing a ROM from the ZX80, touch the modulator (silver box in the rear). When you plug the ROMs into the new board, push them all the way in (till the pins pop into place) to make good contact. Yet be careful not to bend the pins--they might snap. Three capacitors on the ZX80 board will get in the way--bend these down carefully until the ROM socket pins can plug into the socket on the ZX80 board. With these precautions and a good PC board, you'll be able to use either ROM without removing one each time, risking broken pins.--AZ

THE FLAGS REGISTER

(This is part 3 of 12 short pieces on machine code programming on the ZX80/1--AZ)

The Flags register, F, is the other half of the Accumulator pair, AF. The Accumulator (or A register) is where the results of operations (like add and subtract) are stored. The Flags register tells you something about the value in the A register. AF is just like the other register pairs HL, BC, DE, etc., except that the AF pair changes with each manipulation; all of the others change only when specifically instructed to do so.

Instead of values for each bit position, the Flags register holds information for testing. Each bit stands for a different condition and can be either 0 or 1 (0=flag not set, 1=flag set). Each bit represents the information:

FLAGS (F)

	S	Z	-	H	-	P/O	N	C
(bit)	0	0	0	0	0	0	0	0

ACCUMULATOR (A)

	128	64	32	16	8	4	2	1
(bit)	0	0	0	0	0	0	0	0

Bit 7--S sign (0 if +, 1 if -)
6--Z zero (0 if result of operation WAS NOT 0, 1 if result WAS 0)
5--not used
4--H half carry (used internally, not testable)
3--not used
2--P/O parity/overflow (parity is testable)
1--N add or subtract (used internally, not testable)
0--C carry (1 is a carry from the Accumulator)

Most nonprofessional machine code programmers need thoroughly understand only the Z flag. The others can be studied when necessary. For instance, if you have an address in REM for data (<128; + or - value), you can load A with that value, test bit 7 (the Z flag) to see if it is positive or negative, then continue depending on what is in the Z bit.

Here's what happens: when bit 7 is tested, the Z flag will show 0 if the bit is 1 (negative value) or 1 if the bit is 0 (positive value). It sounds confusing, but just remember 0 in the Z flag means negative; 1 means positive. If the next instruction is JR Z (jump relative to Z), then the computer will jump if Z=1 (similar to IF...THEN GOTO in BASIC). If Z=0, the computer just goes to the next instruction.

The Z80 offers thousands of possible bit-test/test-and-branch combinations...try a few.

Next: LOADING REGISTERS WITH DATA

Jon Bobst, Zeta Software, PO Box 3522, Greenville, SC, 29608-3522

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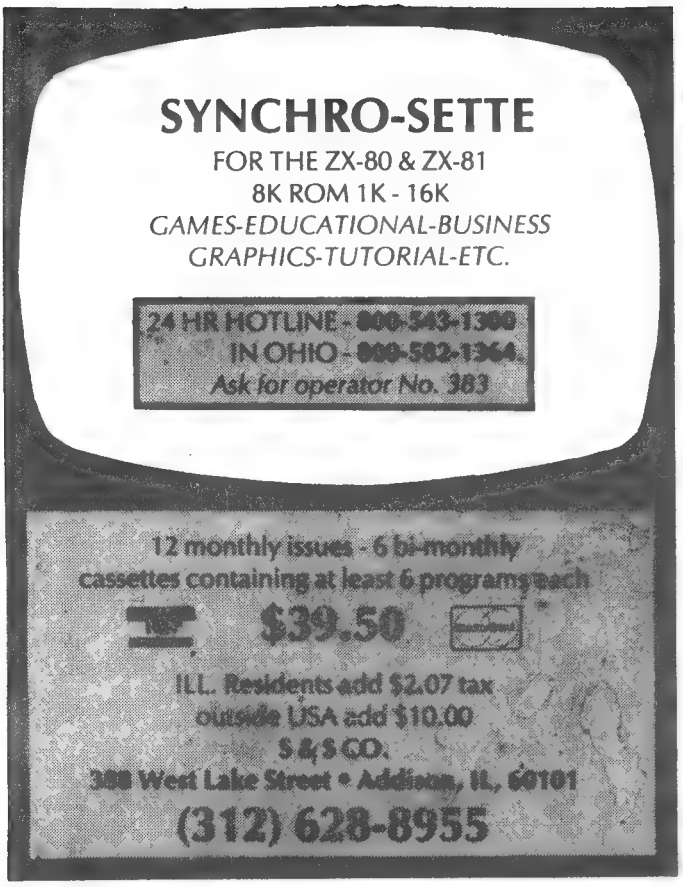

SOFTWARE REVIEW

Programs: Video-Plan,
Computacalc
Price: V-P £9.95 deluxe,
£7.95 standard
CC $39.95 US
ROM/RAM: 8K/16K, ZX81 only
From: V-P--Video Software Ltd. Stone Lane, Kinver, Stourbridge, West Midlands, UK DY7 6EQ
CC--Mindware Co., 70 Boston Post Rd., Wayland, MA 01778 (written by Silicon Tricks, London)

Electronic spread sheets (like Visi-Calc) let you analyze or model business and financial problems quickly and easily. You can try changes, make corrections, and play with alternatives. Any task using rows/columns of numbers you can carry out with these two programs.

Computacalc and Video-Plan run on ZX81s with 16K RAM. Neither runs on upgraded ZX80s. Both are written in BASIC, run slowly, can be LISTed, work with ZX printers, have mostly OK input error trapping and recovery, left-justify entries (decimal points do not line up), and let you force recomputation.

Neither program lets you move rows or columns automatically, nor can you insert rows or columns. As a user, I miss these functions. As a rotten typist, I also miss the ability to edit complex formulas.

Each program emphasizes a different approach to analysis--CC is cell-oriented, V-P is column-oriented.

Documentation for each program is poor. The notion persists among software suppliers that one manual can serve to sell, instruct, exemplify, explain, and catalog. Once you learn to use the program, you will find looking through the examples just to find a command annoying. Of the two, V-P did the better job.

CC's manual fits in the cassette case--4 1/2 columns of type set 13 lines to the inch. You get an example that demonstrates most commands, a list of options to respond to the major prompt, and two hints to modify the program.

V-P uses larger type and provides a 19-page booklet that covers similar topics. Three pages describe suggested applications, and three are devoted to titles and contents. Each menu option is fully described by telling the consequences of each permissible response. Chapter 5 on functions lacks clarity and does not explain which columns may have subtotals.

In most cases the effect of erroneous entries is explained. Both programs can behave badly without warning the user, though CC exhibited fewer of these problems. Any long tape can load with a few errors which may cause the program to crash after a while. That's a needless annoyance--run the Syntactic Sum of these programs when you first get them and at every load thereafter.

V-P exhibited defects so serious that I must rate it unacceptable until they are cleared up. You can print a table with data and titles misaligned; subtotals can be arithmetically incorrect; and you can confuse the program so that the spread sheet calculates subtotals at intervals other than those you asked it to. All of these occur without warning.

CC can give the usual least-signicant-digit error between row and column totals, resulting from round-off error.

Both programs provide huge grids, much to their detriment. Neither gives you any direct control over grid size, and both calculate the whole grid every time. V-P took about 10 minutes to retotal the sheet after changes--most annoying. CC is much faster when you use small portions of the sheet since it only calculates formulas you put in, whereas V-P always does all row functions and column totals--nice, but slow.

V-P only allows functions between columns, but displays the function below the column at all times. In CC, you define cell relationships freely, but you'll never see them again unless you write them down. The function labels just serially number the formulas you put in.

V-P handles titles separately from data, so they don't scroll off the screen, but V-P doesn't move the row titles and data together as it does the column labels. CC treats the labels as data, and scrolls them off screen on large grids. Neither program provides a title lock, nor does either let you adjust the row title size independent of the data block.

Despite the shortcomings, I am delighted to see programs of this type becoming available for the ZX81. Computacalc is a usable program and both are recommended for programmers who want to see how to do these functions in BASIC.--KO

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8K FLASHING PROMPTS SUBROUTINE

To avoid screen flicker, I came up with this subroutine (at 200 in this example). The example program gives 6 flashing prompts. To change the number of flashes, change 6 in line 145. For different periods between flashes, change 3 in line 215. Run in SLOW mode.

Rois Harder, N. Van, B.C., Canada

```
100 PRINT AT 21,6;"(0 TO 11)"
105 PRINT AT 21,0;"INPUT"
110 LET P=0
115 GOSUB 200
120 PRINT AT 21,0;"     "
125 GOSUB 200
130 PRINT AT 21,0;"INPUT"
135 GOSUB 200
140 LET P=P+1
145 IF P=6 THEN GOTO 155
150 GOTO 120
155 INPUT A$
200 LET T=0
205 LET T=T+1
210 IF T=3 THEN RETURN
215 GOTO 205
SYNTACTIC SUM:   19157, 8K
```

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CURING 16K RAM RANDOM DUMPING

My 16K RAM pack tended to dump its memory if my ZX81 was moved, wiggled, or tapped, or if the RAM pack was squeezed. Sometimes it dumped for no apparent reason. I suspected the problem was caused by dirty contacts at the edge connector, but cleaning the contacts had no effect. The cause was mechanical instability in the RAM pack itself. The problem took only five minutes to fix, and now my ZX81 with 16K attached can withstand any amount of wiggling, shaking or thumping without a memory dump. This procedure worked for me:

- Open the RAM pack case by removing the 4 screws and pulling the halves apart gently. Inside are 2 boards hinged together at the top by a ribbon cable, book-fashion.
- Inside the front and rear halves of the case you'll find large tan-colored cardboard insulators. With a pair of scissors, trim the notches in the insulators so they just clear the screw posts.
- On a lower corner of the front board (the one with the blue plug attached) you will note 2 grounding springs that are designed to make contact with the metallized coating of the case when it is assembled. Inspect this area of the board to see if the pins running from the blue plug project far enough above the rear of the board to make contact with the grounding springs when they are flexed. If this appears possible, nip off the projecting pin ends as close as possible to the surface of the board and cover them with a piece of vinyl electrical tape.
- On the boards in my unit, only 2 of the electrolytic capacitor cans

BOOK REVIEW

Title: Machine Language Programming Made Simple for Your Sinclair ZX80 and ZX81
By: Melbourne House Publishers
Price: $19.95, 160 pgs, paperback

I wanted to review this book because I'm the person it was written for. The ZX80 and ZX81 have been my only computers. I taught myself BASIC and can now do most of the things I want to with it. I felt that machine language (ML) would be a good addition to speed up some programs and improve display. The idea of ML "made simple" appealed to me.

This quality spiral-bound volume starts on a very elementary level, explaining how the computer counts and stores numbers. It goes through the various registers for both the ZX80 and ZX81. You learn to manipulate the registers and keep track of them.

Each ML command is explained with exercises as learning aids. At the end two fine indexes list the Z80 commands both by number and alphabetically by mnemonic code. All instructions are in hexidecimal

numbers, not decimal. Most articles I've seen are in decimals.

Being uninitiated to ML, my main problem was: what do you do with it? I felt like I learned all the skills of woodworking but not to build anything. A program combining BASIC and ML is included at the end, but I found it hard to follow and felt it lacked sufficient explanation to make it useful.

Don't order this book for quick ML routines to plug into your programs. Instead, you'll find a book that seems to give a good background in ML to help you understand and build on further information found in other articles.

Michael Roberts, Des Moines, IA

This book doesn't offer immediate applications, but it's the best explanation of ML for ML beginners I've seen. Its friendly style is painless reading and simple analogies help make this language clear. This introduction is a must before moving to books like Zak's Programming the Z80. From from Gladstone Electronics, 901 Fuhrmann Blvd., Buffalo, NY, 14203, or 1736 Avenue Rd., Toronto, Ontario, M5M 3Y7.--AZ

---

had vinyl electrical tape on top of the cans to prevent shorting to the opposing board when the boards were folded together. Place vinyl tape on top of ALL the cans, and as an extra precaution stick a strip of tape on the bottom surface of the opposing board.

- Reassemble the RAM pack, making sure that the lower grounding spring on the front board makes contact with the metallized coating on the inside of the of rear half of the case. If necessary, bend it gently to insure that it makes proper contact. The side grounding spring will be pinched between the two halves of the case when it is properly assembled.

Burt Haberman, Tuscon, AZ

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WANTED: ZX-80, 8K ROM, 1K RAM and all paraphernalia that came with the machine upon original purchase, especially programmers manual. State sales offer in writing, including telephone number, and mail to: Michael Wido
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12 issues, $29. Single issue, $4.

Publisher: Kirtland H. Olson
Editor: Ann L. Zevnik

Printed by Joseph E. Marhefka, Jr.
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